

BIOSYSTEMATIC AND TAXONOMIC STUDIES IN *HOMERIA* (IRIDACEAE)

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ABSTRACT

Ecological, cytological and morphological data are presented in comparing two western Cape (South Africa) species of *Homeria*, *H. collina* (also known as *H. breyniana*) and *H. flaccida* (= *H. breyniana* var. *aurantiaca*). The evidence presented is used as reason for raising the rank of *H. flaccida* from varietal status to species. A brief taxonomic history of both species, explaining the nomenclatural changes, is followed by synonymy and brief descriptions.

UITTREKSEL

BIOSISTEMATIESE EN TAKSONOMIESE ONDERSOEK VAN *HOMERIA* (IRIDACEAE). Ekologiese, sitologiese en morfologiese data word aangebied waar twee Wes-Kaapse (Suid-Afrika) soorte *Homeria*, nl *H. collina* (ook bekend as *H. breyniana*) en *H. flaccida* (= *H. breyniana* var. *aurantiaca*) vergelyk word. Die getuigenis aangebied word gebruik om *H. flaccida* van varieteits rang na soort rang te verhef. 'n Kort historiese oorsig oor die taksonomiese geskiedenis van beide soorte se naamsverandering word gevolg deur 'n lys van sinonieme en kort beskrywings.

INTRODUCTION

Homeria is a common genus of the Iridaceae in many parts of South Africa and is very well represented in the winter rainfall area of the south western Cape. The genus, many species of which are known locally as tulps, comprises about 35 species all of which are herbaceous geophytes usually flowering in spring or summer. Several species have been cytologically studied (Goldblatt 1971); the basic chromosome number (x) is 6 and while most species are diploid, $2n = 12$, two tetraploids, $2n = 24$, (*H. pura* from the Transvaal and *H. collina*), and one hexaploid, $2n = 36$, (*H. flaccida*), are known. The two species dealt with in this paper have long been known to science and to local botanists, and are common within their range in the south western Cape. *Homeria flaccida* Sweet, treated since the end of the nineteenth century (Baker, 1892) as var. *aurantiaca* of *H. collina* (either as *H. collina* or as *H. breyniana*) is regarded as a distinct species in this paper. A suggestion to this effect was first made by the present author (Goldblatt 1971) based mainly on chromosomal evidence. The discovery of naturally occurring sterile hybrids in 1970 stimulated a deeper investigation of these two taxa and the author now feels fully justified in changing the rank of var. *aurantiaca* to species level.

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In reviewing the taxonomy of these species, name changes of both were found necessary. A brief resume of their taxonomic history is therefore presented following the discussion of ecology and morphology and the studies of chromosome cytology in these two species and their hybrid.

BIOSYSTEMATICS

Ecology and phenology

Homeria collina is a very early flowering species often found in full flower from May or June to early August. Late flowering plants are not uncommon and scattered individuals may be found at higher elevations even in late September. *Homeria collina* is fairly tolerant of different habitats and can be found commonly from sea level to altitudes of above 600 feet, either in clay or sand (the two major soil types in its geographic range). Morphologically it is distinct, having a comparatively large flower for the genus, but it is slender and seldom has more than one branch. The flower which may be pale pink or pale yellow, is somewhat cup-shaped at the base, with only the upper parts of the perianth spreading.

Homeria flaccida is on the other hand a late flowering species most common in early October. It shows a preference for moist situations and is usually found in seasonally inundated depressions or marshy places and never occurs at high elevations. It is a robust, usually much branched, tall and many flowered species. The flowers are large, more open than those of *H. collina* with the perianth segments spreading from the base, and they are bright orange with a yellow streak at the base of each petal. Live specimens cannot be confused with those of any other species, but much character is lost when dry. One feature, a very long ovary, is characteristic and though it is variable, it is amongst the longest of all species of *Homeria*.

*Cytology**

The chromosomes of *H. collina* were first described by Sakai (1952) who reported $2n = 24$. Subsequently the present author (Goldblatt 1971) confirmed the report for this species (under the name *H. breyniana*). *Homeria flaccida* (as *H. breyniana* var. *aurantiaca*) was described as having a diploid number of $2n = 36$, also by Goldblatt (1971). Present observations confirm these records for several populations of both species. Both yellow and pink forms of *H. collina* have a diploid number of $2n = 24$. Meiotic studies of both species reveal no unusual behaviour of the chromosomes. Both species are obligate out-crossers.

* The cytological method employed here is the same as that previously described by the author (Goldblatt 1972).

TABLE 1.

Chromosome numbers in several populations of *Homeria flaccida* and *H. collina*. Voucher specimens collected by the author are housed at the Bolus Herbarium, University of Cape Town.

Species	Diploid number	Locality
<i>H. flaccida</i>	2n = 36	Kommetjie, Cape Peninsula
	36	Mud River Farm, Darling
	36	Twenty Four Rivers, Gouda
	36	Kirstenbosch, Cape Peninsula
<i>H. collina</i>	2n = 24	Paarl, Cape
	24	Lions Head, Cape Peninsula
	24	Fish Hoek, Cape Peninsula
	24	Oudekraal, Cape Peninsula

Hybrid Studies

At one site on the Cape Peninsula hybrid plants (*H. flaccida* × *H. collina*) were found. These resemble *H. flaccida* in habit, but have flowers intermediate in size and colour between those of *H. flaccida* and those of *H. collina* and have a diploid number of $2n = 30$ (fig. 1: C). Growing amongst the hybrids were several typical plants of *H. flaccida* but no *H. collina* were found still in flower, although numerous seed-bearing plants were located nearby. The hybrids were growing in a disturbed habitat along a roadside in a thick growth of Kikuyu grass (an exotic species, *Pennisetum clandestinum* Hochst. ex Chiov.)

The hybrids were all sterile but corms transplanted to a test site produced healthy plants in following seasons. Crossing with pollen of both parent species failed to produce any seed at all.

Meiosis and microspore development

The hybrids, all with 30 somatic chromosomes, exhibited several abnormalities during meiosis, typically recorded for triploids or pentaploids. Pairing at diakinesis varied, and between 9 and 12 bivalents and between 12 and 6 univalents were found (fig. 1: A). The unpaired chromosomes usually lie on the periphery of the metaphase plate and lag during anaphase. This commonly results in their exclusion from the nuclei formed during telophase of the first division of meiosis and subsequently the second meiotic division. A tetrad of large, normal looking nuclei regularly forms, while several micronuclei may be found, presumably each containing only the single chromosomes which had failed to pair during early meiosis (fig. 1: B).

Both normal looking pollen and micro pollen grains are ultimately produced by the hybrid. The bulk of the normal sized pollen is apparently fertile and stains brightly in aniline blue. In spite of the appearance of this pollen, no fruit development or seed is ever produced using it as male parent in crosses with the hybrid or with either parent. It is clear that no gene exchange is possible between *H. flaccida* and *H. collina* through such hybrids.

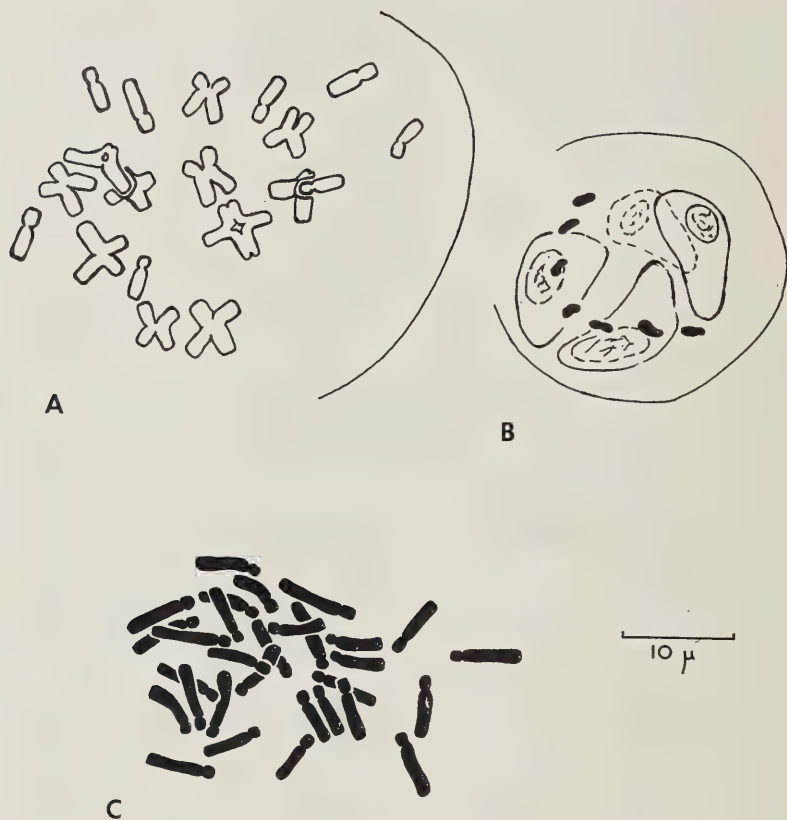


FIG. 1.

Cytology of the hybrid *Homeria flaccida* × *Homeria collina*. A. Meiotic metaphase in pollen mother cell; B. Early tetrad in microsporangium; C. Somatic mitotic metaphase, $2n = 30$ (A and C according to given scale, B half given scale.)

Though it appears that *H. collina* may be one parent of the apparently allohexaploid *H. flaccida*, simply because it is one of the few known tetraploid species of *Homeria*, and the only tetraploid within the range of *H. flaccida*, the absence of a consistent production of 12 bivalents in the hybrid *H. collina* × *H. flaccida* argues against such a simple explanation.

In the only other interspecific hybrid in *Homeria* known to the author, an artificially produced cross between *Homeria miniata* and *H. elegans*, both diploid

species, pairing was frequently normal, though in a few cases two univalents occur. Like the *H. flaccida* $\times$ *H. collina* hybrid it is totally sterile in spite of the normal meiosis in microsporangia and the production 50% normal, apparently viable pollen. The fairly constant production of six bivalents in a cross between two such unrelated species would lead one to assume that if *H. collina* were one ancestor of *H. flaccida*, then regular pairing should be expected in the *H. collina* $\times$ *H. flaccida* hybrid. It is however clear that more cytological studies are necessary in the genus, especially in hybrids, before the evolution of polyploid forms such as *H. flaccida*, or for that matter *H. collina*, can be understood.

TAXONOMY

Homeria collina (Thunb.) Vent.

This species was first described by Thunberg (1787) who recorded it as a *Moraea*. Thunberg's clear observations on its early flowering habit, its abundance and the occurrence of both yellow and pink forms on the Cape Peninsula make it easy to recognise and its identity has never presented problems. It is typified by adequate material at the Thunberg Herbarium in Uppsala.

In 1941 Lewis reduced *H. collina* to synonymy as she believed that a previously described Linnaean species *Tulipa breyniana* was conspecific. This latter species is described only from an illustration in Breyne (1678), later copied by Rudbeck (1701), of what clearly seems to be a poorly illustrated, already wilted plant possibly a *Homeria*. This picture (fig. 2) is obviously partly based on a true plant and partly on the artist's reconstruction of what he imagined the wilted specimen was, in this case a tulip, and the gynoeceum of a tulip is represented on what otherwise is probably an *Homeria*. Lewis believed this species to be the same as *H. collina*, an assumption which under the circumstances appears unwarranted. While the present author does not argue with her generic determination, it seems most unsatisfactory to attempt specific determination from the poor illustration, especially as *Homeria* is a very difficult genus in which to identify species. Apart from this it appears to the present author that *Tulipa breyniana* is closer (though this cannot be confidently stated) to other species of *Homeria*, e.g. *H. ochroleuca* or *H. comptonii* rather than to *H. collina*. The description given by Breyne does not help, and in fact, without the illustration it is impossible even to suggest the identity of his *Sisyrinchium ex phoeniceo suaverubente flore Aethiopicum*. Thus it is advisable to reject *Tulipa* (or *Homeria*) *breyniana* and revert to the name *Homeria collina*.

Homeria flaccida Sweet

This plant, named by Sweet in 1826, is based on the illustration in Curtis' Botanical Magazine t. 1612; it was renamed *H. aurantiaca* by Sweet several years later (1830) and it remained known by this epithet until Baker (1892) reduced it to varietal status under *H. collina*. Lewis (1951) continued to regard

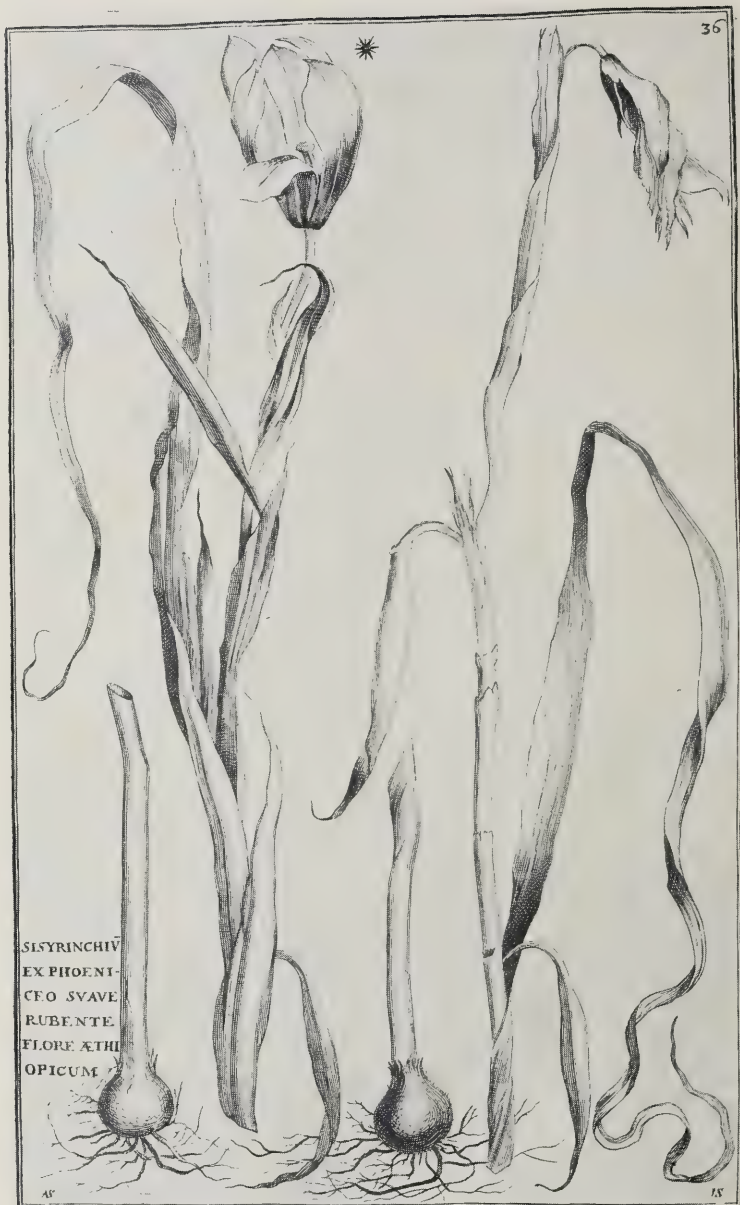


FIG. 2.

this plant as a variety of *H. collina*, as *H. breyniana* var. *aurantiaca* (Sweet) Lewis. It is raised to specific status once again, based on the ecological, morphological and cytological evidence presented in this paper.

As complete a synonymy as is currently known is presented together with brief descriptions.

1. ***Homeria collina*** (Thunb.) Vent., Decad. no. 2: 5 (1808).

Moraea collina Thunb., Diss. Moraea.: 11, no. 13 (1787).

Sisyrinchium collinum (Thunb.) Cavan.,¹ Diss. 6: 346 (1788).

Homeria breyniana sensu Lewis in Jl S. Afr. Bot. 7: 57–59 (1941) non *Tulipa breyniana* L.

Plants rarely exceeding 45 cm, slender, seldom bearing more than two branches. *Produced leaf* narrow and inserted well above ground level. *Flowers* pale yellow or salmon pink, segments fading to pale greenish yellow near base; *perianth segments* unequal, outer larger; held erect with distal parts only spreading; segments widening gradually towards apex. *Filament* column distinctly pubescent; *anthers* reaching to base of stigmas. *Ovary* 1–1.6 cm long; *capsule* rarely exceeding 3 cm.

Type: Cape Peninsula, Thunberg in Herb. Thunb. (UPS, holotype!).

Distribution: southern and south western Cape.

Flowering time: May to September.

2. ***Homeria flaccida*** Sweet, Hort. Brit. ed 1: 395 (1826), based on *H. collina* var *miniata minor* Ker in Curtis' Bot. Mag.: t. 1612 (1814).

Moraea flaccida (Sweet) Steudel, Nom. ed 2: 160 (1840).

Homeria collina var *flaccida* (Sweet) Klatt in Linnaea 34: 629 (1865).

Homeria collina var *miniata minor* Ker in Curtis' Bot. Mag. t. 1612 (1814).

Moraea aurantiaca Eckl., Top. Verz.: 15 (1827) nom. dubium.

Homeria aurantiaca Sweet, Hort. Brit. ed. 2: 498 (1830), based on *H. collina* var *miniata minor* Ker in Curtis' Bot. Mag. t. 1612 (1814).

Homeria collina var *aurantiaca* (Sweet) Bak., Handbk. Irid.: 75 (1892).

Homeria breyniana var *aurantiaca* (Sweet) Lewis. In: Adamson & Salter, Flora of the Cape Peninsula (1950).

Plants tall, robust and usually bearing several branches, reaching to 60 cm. *Produced leaf* broad and strap like, inserted near base of scape. *Flowers* bright orange red, yellow near base of segments; *perianth segments* unequal, spreading almost from base, outer segments equally wide for whole length of limb. *Filament* column barely or not pubescent; *anthers* long and usually exceeding the stigmas. *Ovary* 1.5–2.5 cm long; *capsule* long, sometimes exceeding 4 cm.

FIG. 2.

The type illustration of *Tulipa breyniana* L. which was published in Breyne, *Plantarium Exoticarum Centuria Prima* (1678).

Type: illustration in Curtis' Bot. Mag. : t. 1612 (1814).

Distribution: Cape Peninsula and north to Piketberg and Saldanha Bay.

Flowering time: September and October.

REFERENCES

- BAKER, J. G., 1892. *Handbook of the Irideae*. London.
- BREYNE, J., 1678. *Plantarum exoticarum centuria prima*. Danzig.
- GOLDBLATT, P., 1971. Cytological and morphological studies in the Iridaceae. *Jl S. Afr. Bot.* 37: 317-460.
- , 1972. Chromosome cytology in relation to classification in *Nerine* and *Brunsvigia* (Amaryllidaceae). *Jl S. Afr. Bot.* 38: 261-275.
- KER, J. B., 1814. *Homeria collina* var *miniata minor*. Curtis' Bot. Mag. : t. 1612.
- LEWIS, G. J., 1941. Iridaceae. New genera and miscellaneous notes. *Jl S. Afr. Bot.* 7: 19-59.
- , 1950. Iridaceae. In: Adamson, R. S. and Salter, T. M. (ed.), *Flora of the Cape Peninsula*. Cape Town: Juta.
- RUDBECK, O. (pat. et fil.), 1701. *Campi Elysii liber secundus*. Uppsala.
- SAKAI, B., 1952. Zytologische Untersuchungen bei Iridaceae. Über die Karyotypen verschiedener Arten der Unterfamilie Iridoideae. *Cytologia* 17: 104-111.
- THUNBERG, C. P., 1787. *Dissertatio de Moraea*. Uppsala.
- SWEET, R., 1826. *Hortus Britannicus* ed. 1. London.
- , 1830. *Hortus Britannicus* ed. 2. London.